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Fesmire et al.

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[45] **Date of Patent: Aug. 28, 1984**

[54] **METHOD AND APPARATUS FOR BATCH CONTINUOUS LAUNDRY PROCESSING**

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[73] Assignee: **Ellis Corporation,** Chicago, Ill.

[21] Appl. No.: **384,928**

[22] Filed: **Jun. 4, 1982**

[51] **Int. Cl.**[3] **F26B 5/08;** F26B 11/08

[52] **U.S. Cl.** **34/8;** 34/58; 34/109; 34/56; 34/126; 34/236; 68/210

[58] **Field of Search** 198/436, 437, 631, 586; 68/210; 34/8, 58, 56, 109, 133, 129, 126, 236

[56] **References Cited**

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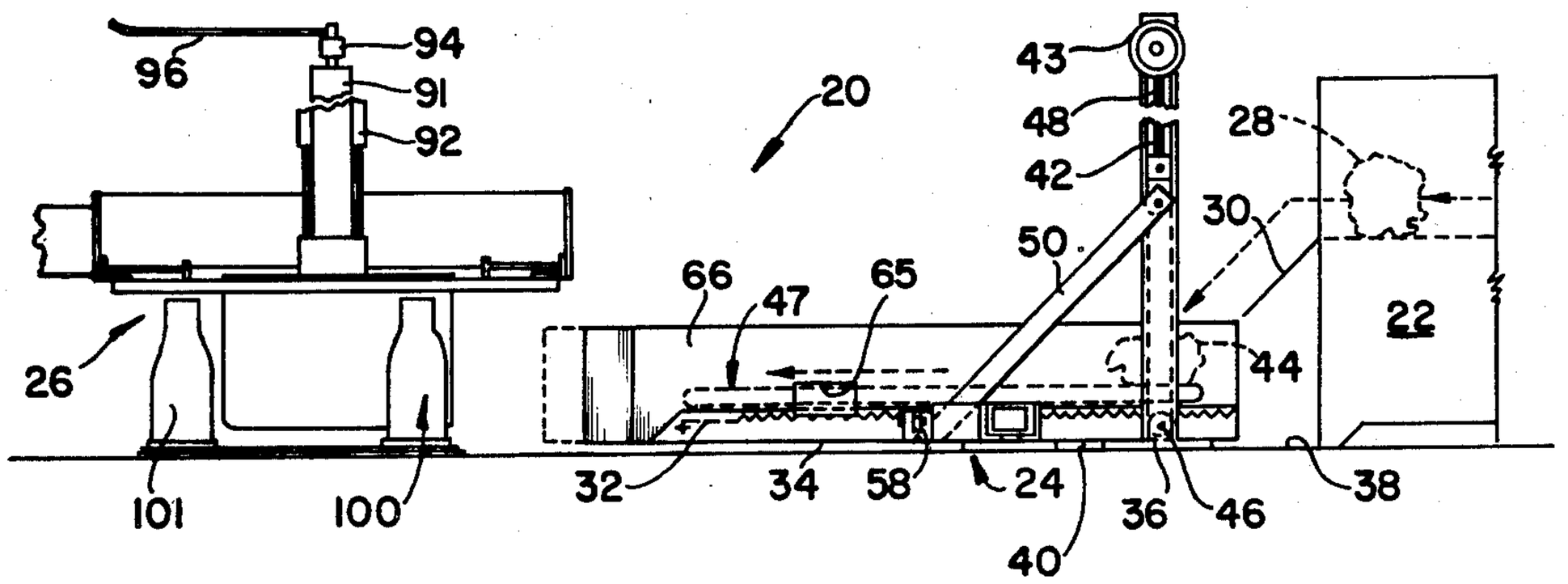
Primary Examiner—Larry I. Schwartz
Attorney, Agent, or Firm—Mason, Kolehmainen, Rathburn & Wyss

[57] **ABSTRACT**

A method and apparatus for batch continuous laundry processing involves a system for continuously centrifugally extracting fluids from sequentially received batches of washed laundry. The discrete batches of laundry are continuously received by a conveying apparatus that automatically loads the batches into the discrete compartments defined within the segmented drum of the extractor. While the extractor is rotating, the conveying apparatus arranges a plurality of laundry batches to be quickly loaded into the extractor upon completion of the processing of the previous batches so that the conveying and processing is completely continuous and automatic. The conveying apparatus is vertically, laterally and longitudinally translatable to receive the batches from a washer at one level, to arrange the batches in two rows, and then to automatically feed them, for example two at a time, into the compartments of the segmented extractor. After completion of the extraction cycle, batches of laundry are positively and automatically unloaded from each compartment of the extractor in a continuous fashion and in coordination with the loading of the extractor. In one embodiment of the present invention the batches are centrifugally expelled from the drum upon completion of the extraction cycle. In accordance with another embodiment of the present invention each compartment is unloaded using a translating vacuum suction device. The unloading of the extractor is facilitated by a segmented, reciprocating carrier movable into and out of the laundry drum.

55 Claims, 12 Drawing Figures



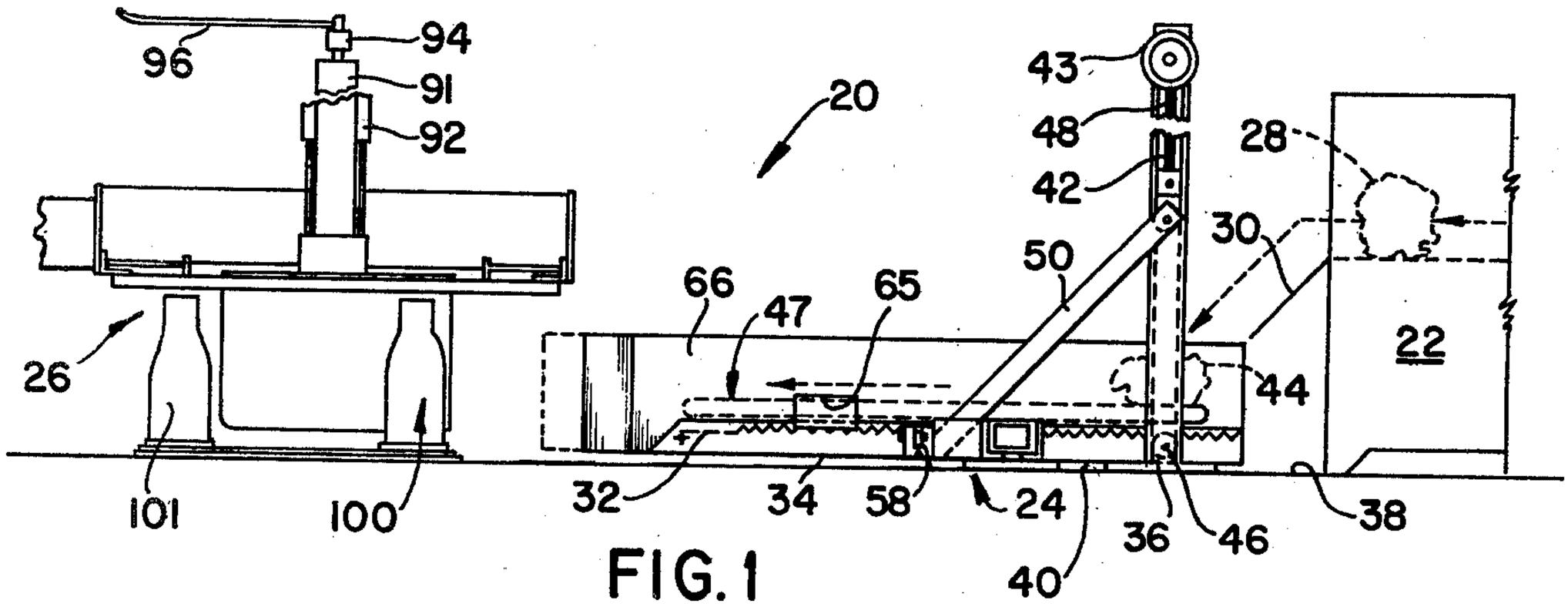


FIG. 1

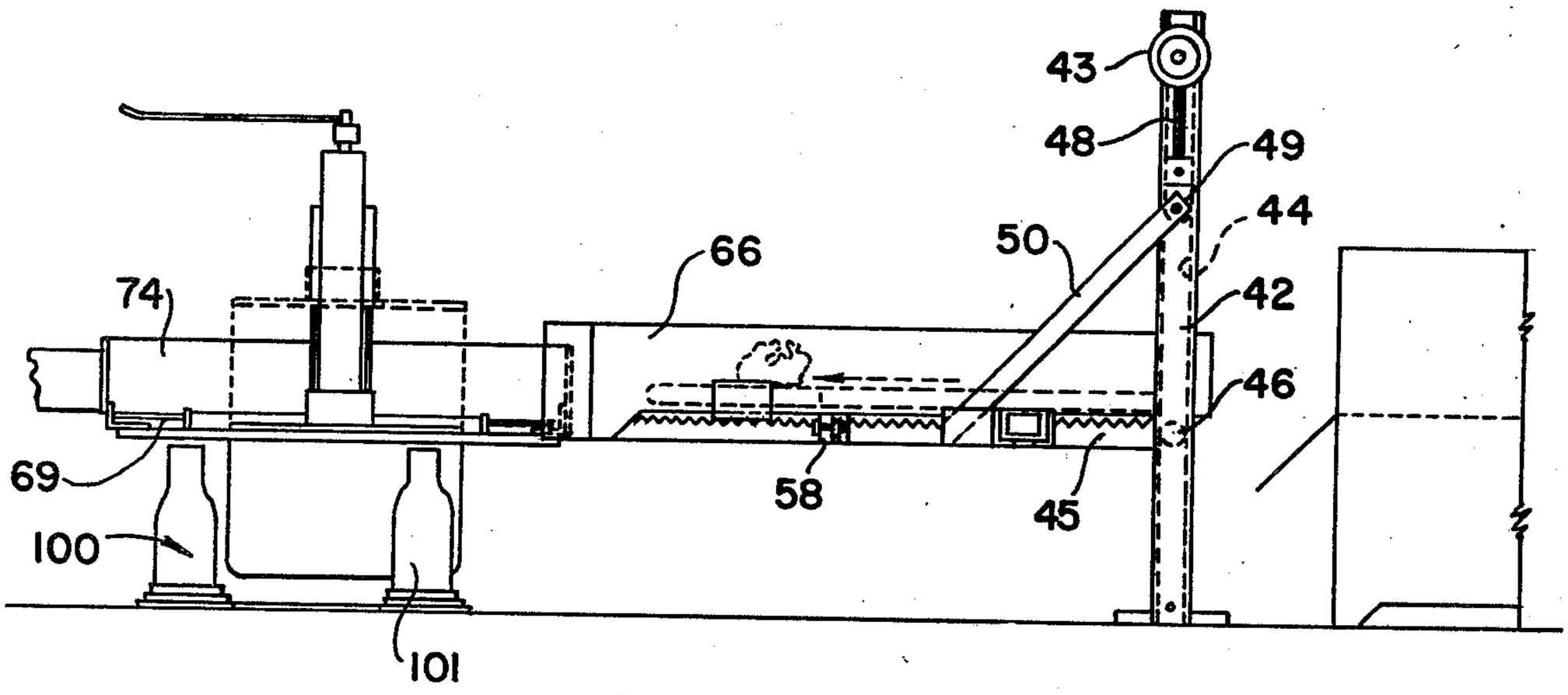


FIG. 2

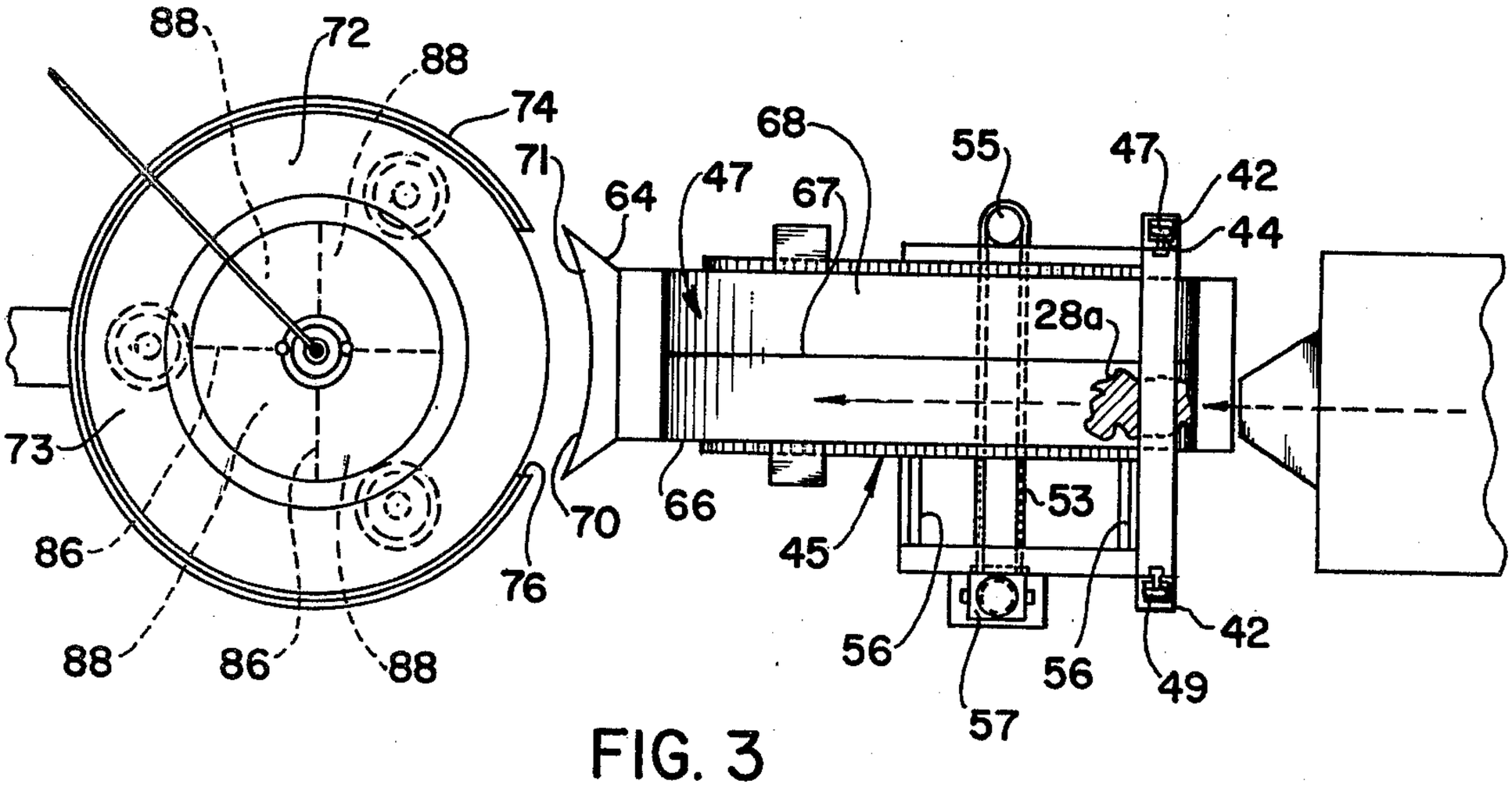


FIG. 3

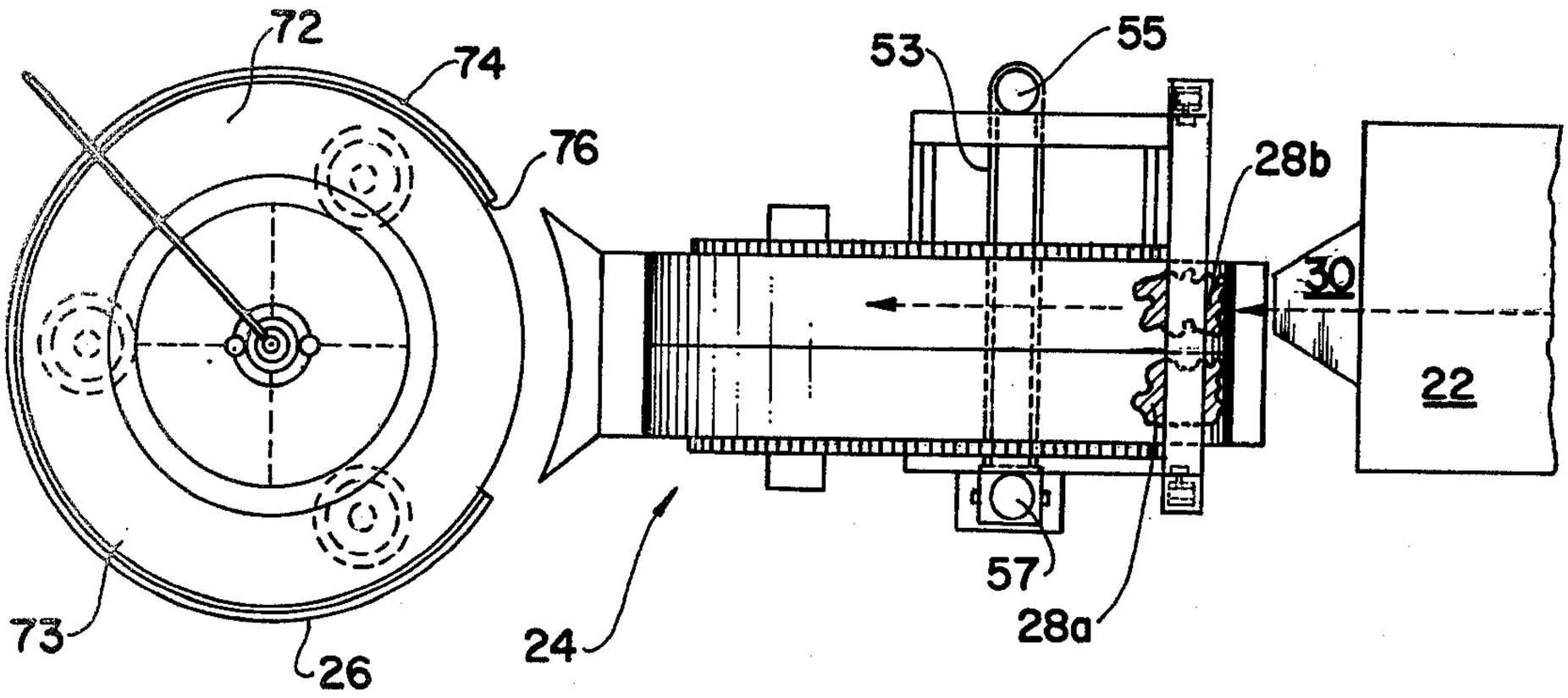


FIG. 4

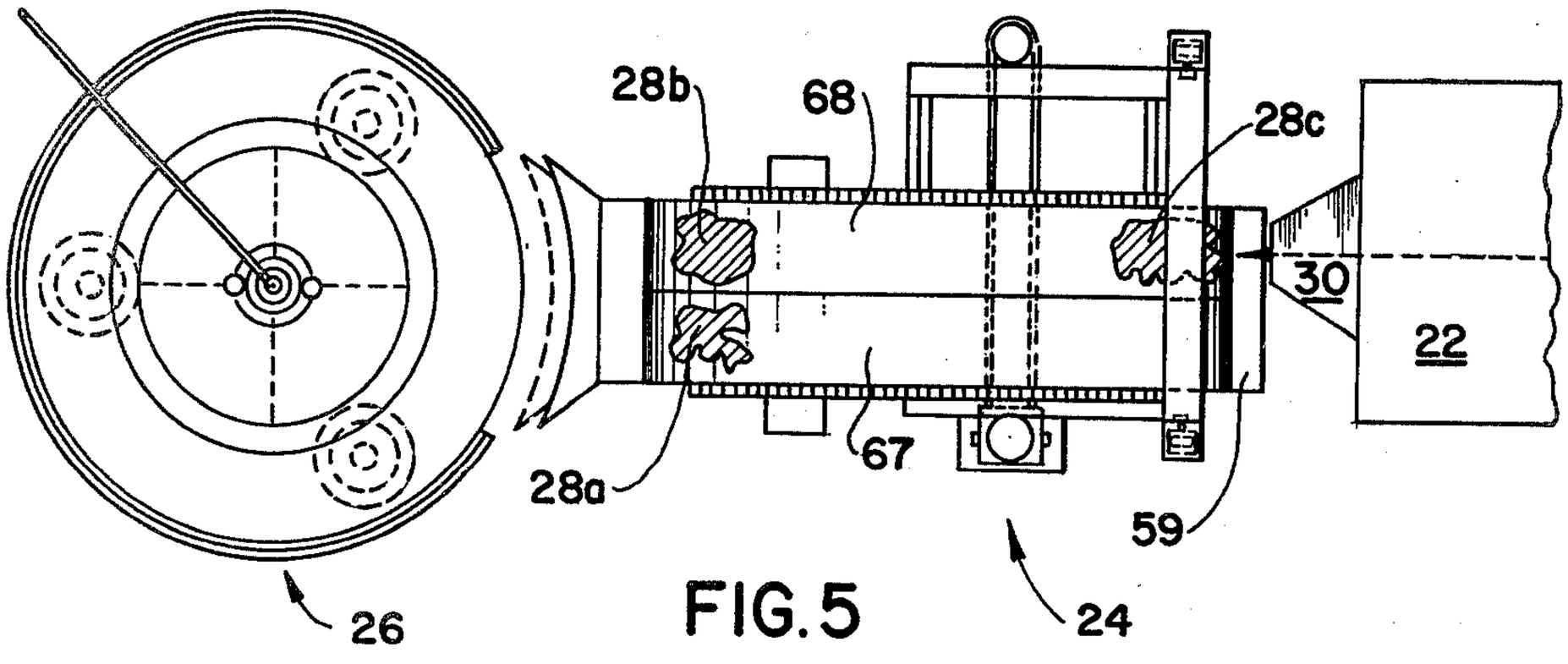


FIG. 5

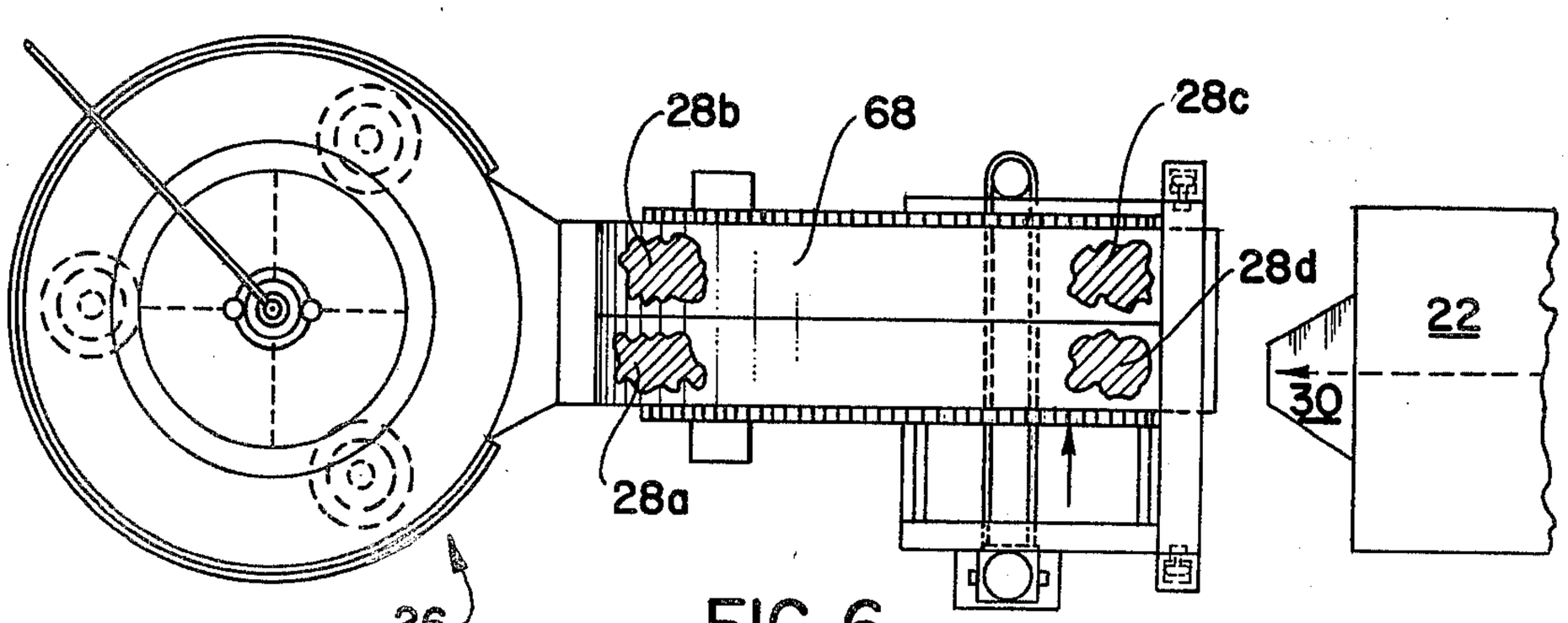


FIG. 6

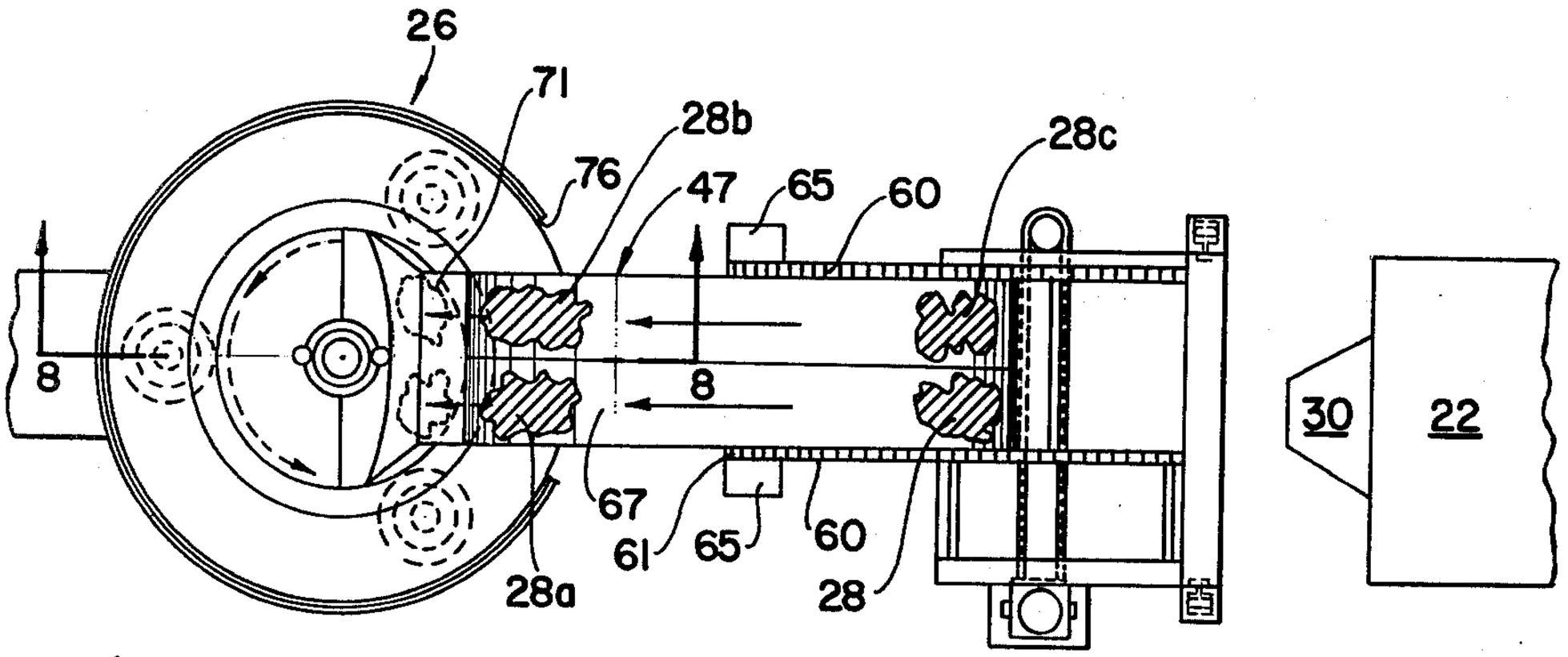


FIG. 7

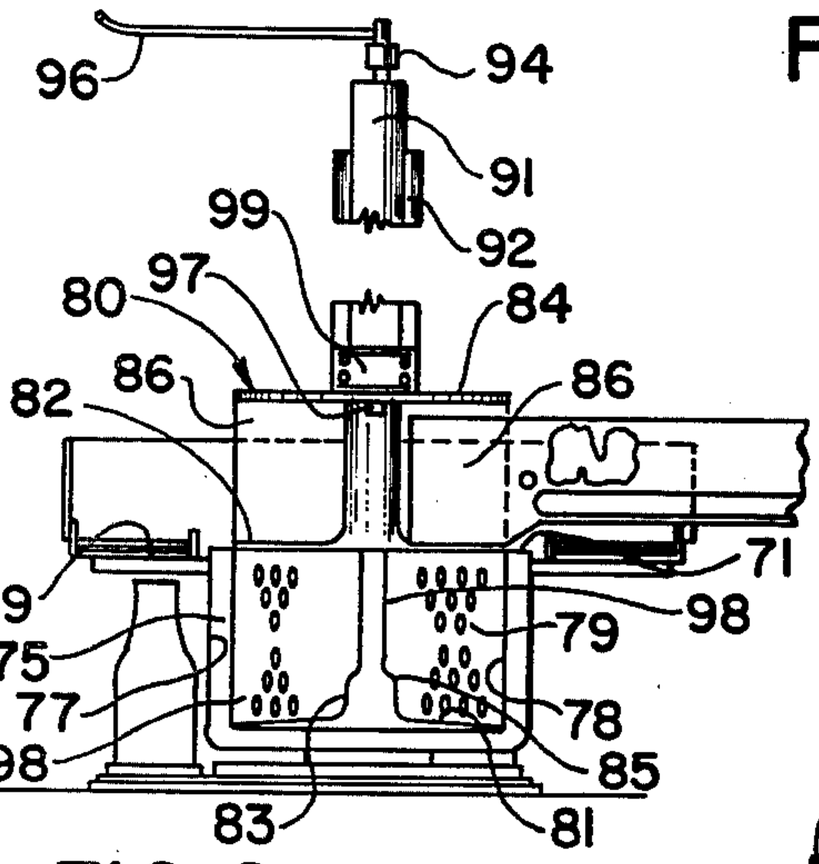


FIG. 8

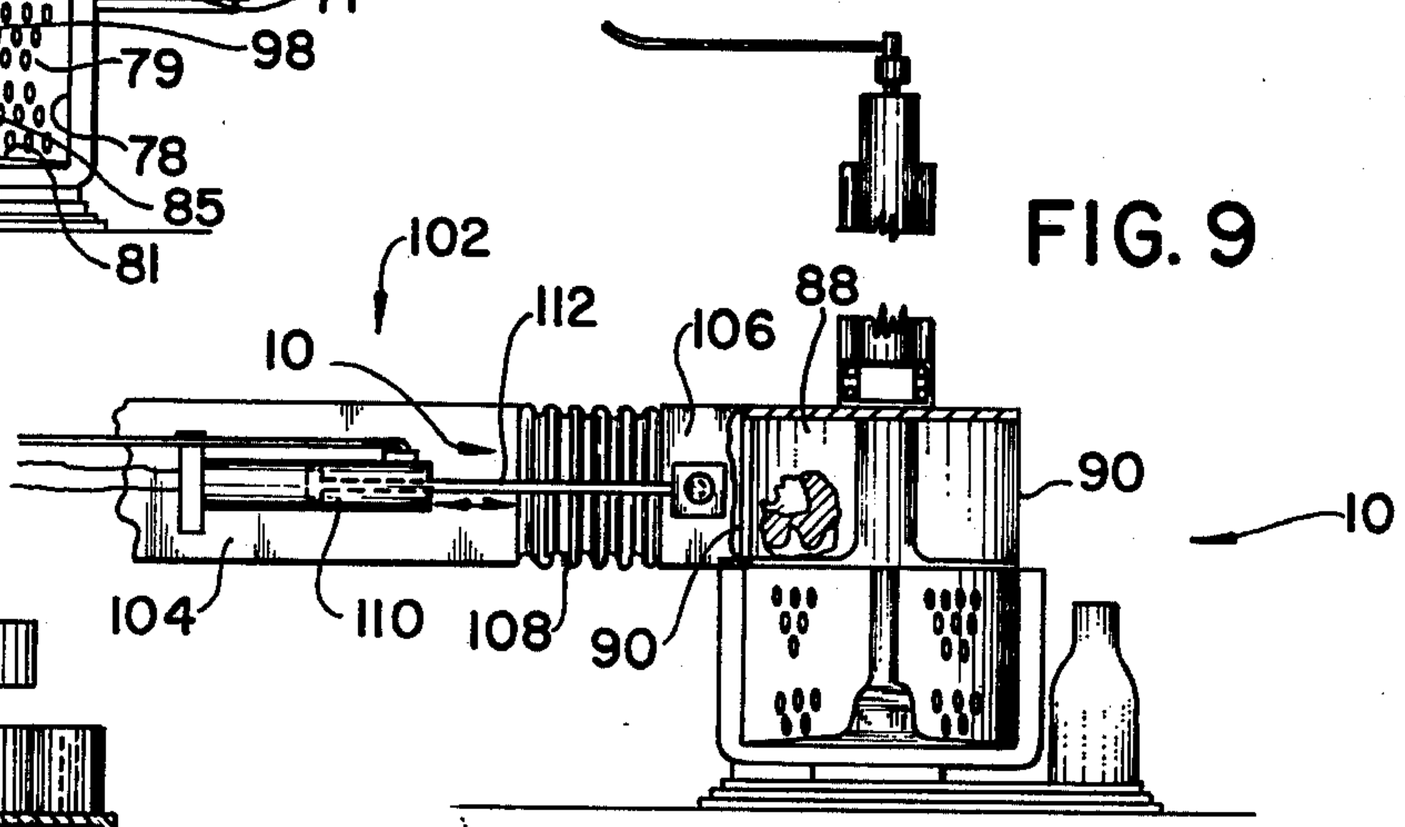


FIG. 9

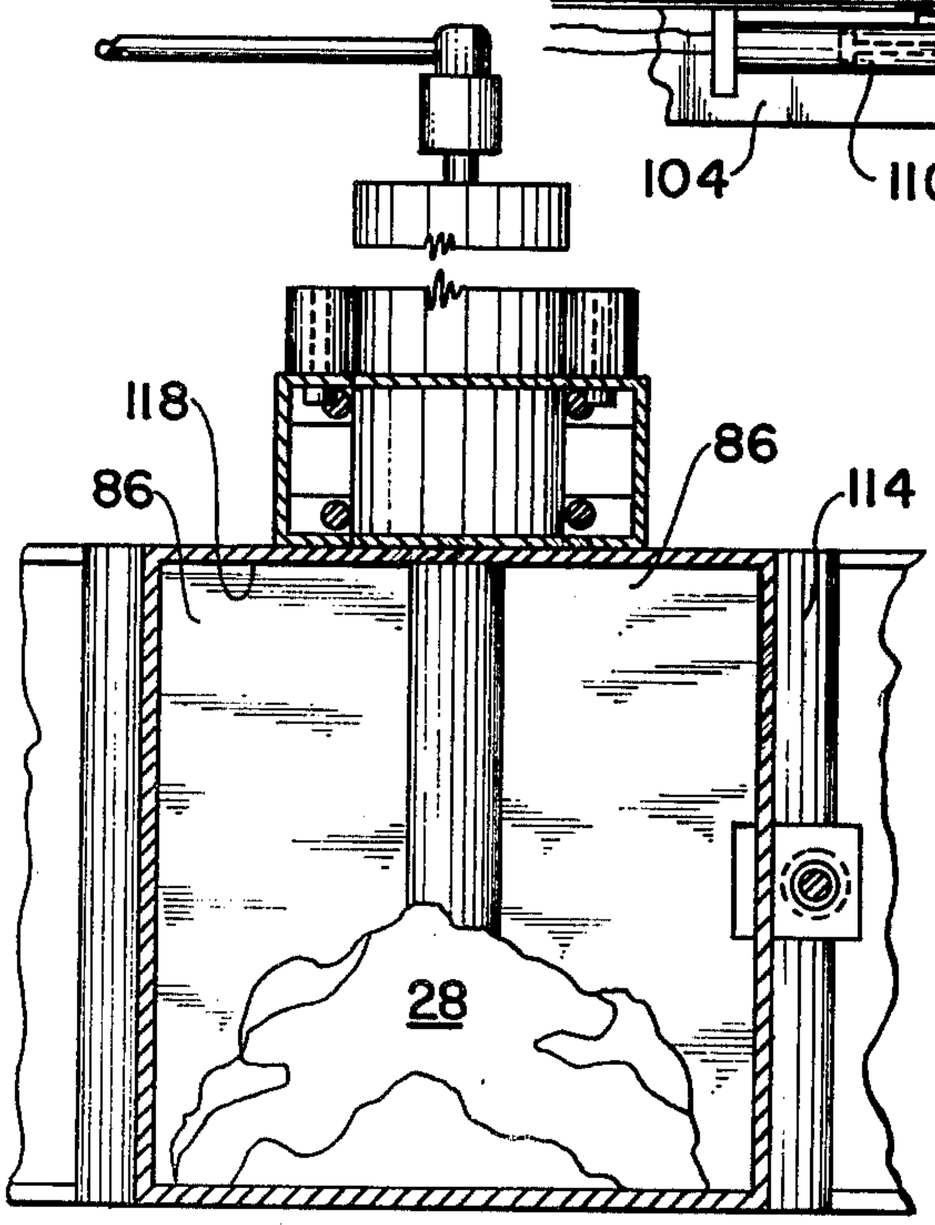


FIG. 11

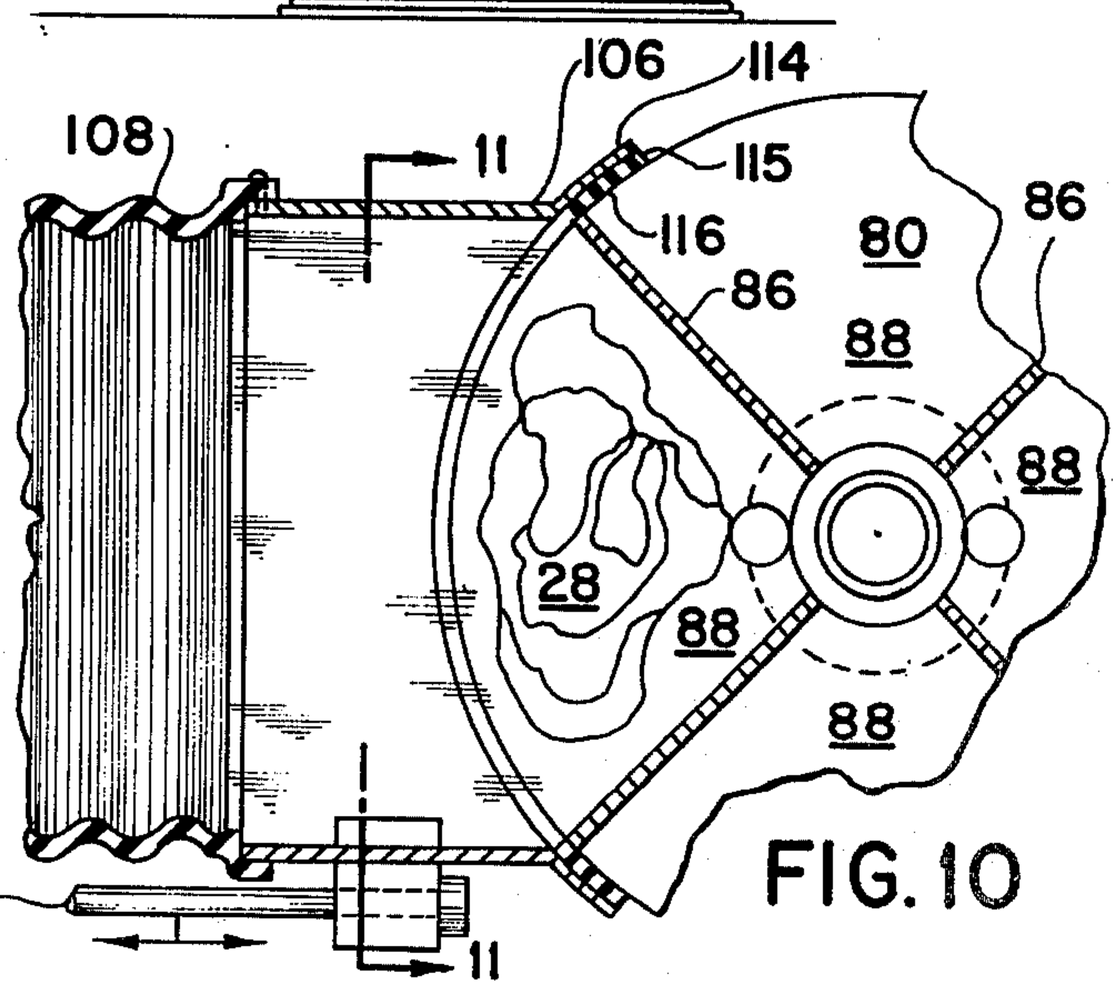
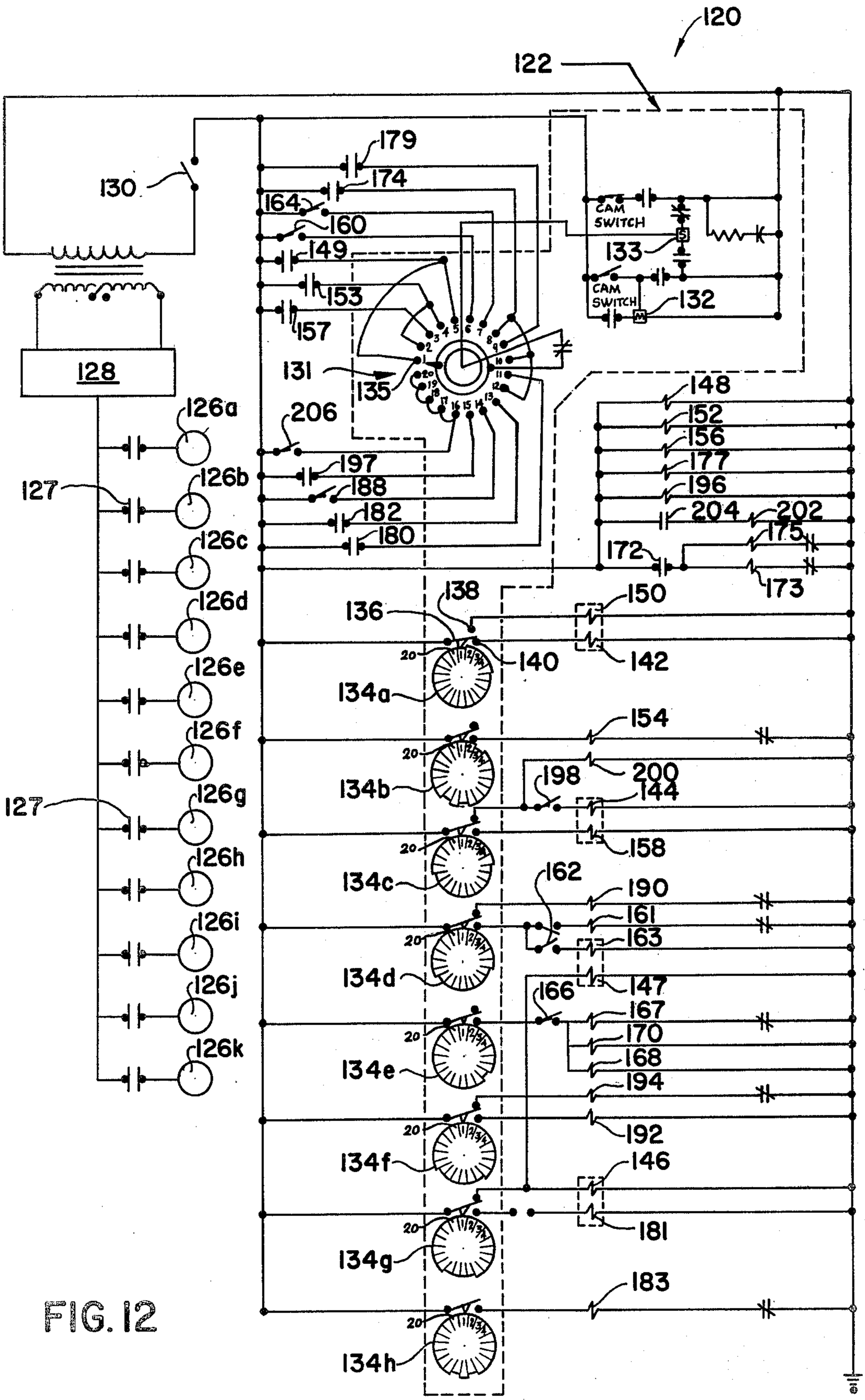


FIG. 10


120
122
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CAM SWITCH
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CAM SWITCH
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177
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172
173
126a
126b
126c
126d
126e
126f
126g
126h
126i
126j
126k
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150
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142
134a
154
134b
198
200
144
158
134c
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161
163
147
134d
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167
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168
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134e
192
134f
146
181
134g
183
134h

FIG. 12

METHOD AND APPARATUS FOR BATCH CONTINUOUS LAUNDRY PROCESSING

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to laundry processing and more particularly to an extraction system that processes laundry in discrete batches in a continuous fashion.

2. Brief Description of the Background Art

With the advent of ultra high capacity tunnel washers which are capable of continuously processing enormous quantities of laundry in discrete batches, the need for more advanced systems of extraction for use in conjunction with these washers has grown dramatically. Tunnel washers have a plurality of sections linked by a rotating archimedian screw, so that discrete batches of laundry may be continuously processed through the washer. Currently, membrane presses are used for liquid extraction in conjunction with tunnel washers. Membrane presses have an internal membrane which squeezes the laundry into a compressed state known as a cheese in order to remove the fluid from the washed laundry. Normally, after membrane-type extraction, subsequent drying, for example in a tumble dryer, is required because these extractors are not highly efficient.

Centrifugal extractors with internal drums that rotate at high speed to centrifugally expel the water or other cleaning fluid from the laundry are known to be highly advantageous in terms of energy efficiency and effectiveness of liquid removal. However, centrifugal extractors are not generally believed to be amenable to high capacity or high output continuous processing. Because of the slow speed of operation of centrifugal extractors, current practice requires the use of a plurality of centrifugal extractors to keep up with one high capacity tunnel washer. Moreover centrifugal extractors generally are incapable of accepting and processing discrete laundry batches, other than one at a time. Thus, due to inefficiencies in transferring between the washers and the centrifugal extractors as well as deficiencies in speed of operation and in loading and unloading efficiency, centrifugal extractors have not been found to be satisfactory for use in conjunction with the high capacity tunnel washers.

A significant deficiency in presently known commercial centrifugal extraction systems is that they are prone to developing non-uniform load distributions resulting in load imbalances destructive to the apparatus. In addition after processing in the centrifugal extractor, the laundry is sometimes difficult to remove because it tends to pack along the peripheral surface of the drum. In U.S. Pat. No. 3,945,921 to Toth a system for automatically expelling the laundry after centrifugal extraction is disclosed. After processing, the laundry is raised out of the extractor drum on a reciprocal wall that is still rotating. The laundry is expelled onto a plurality of surrounding conveyors where it is collected for additional processing. Segmented centrifugal extraction drums that divide the laundry into separate portions decreasing the likelihood of developing imbalance problems are known in the art. U.S. Pat. Nos. 3,577,751, 3,570,273, 2,808,153, 2,534,286, and 1,938,146 disclose washing machines or extractors with segmented, rotating drums.

Automatic systems for processing laundry are also known in the art. For example, U.S. Pat. No. 3,844,142 to Miller discloses a hydraulic press extractor which compresses the laundry into a cake. The extractor is used in conjunction with a conveyor system to automatically process laundry received on the conveyor from a washer. In U.S. Pat. No. 4,285,219 issued to Grunewald an apparatus which uses centrifugal extraction and vacuum conveying in conjunction with conventional commercial laundry machines is taught.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a centrifugal extraction method and apparatus which is capable of continuously and automatically extracting the washing fluid from discrete batches of laundry received from a washer.

It is still another object of the present invention to provide an improved conveyor system for transferring laundry from a washing machine to a centrifugal extractor.

It is another object of the present invention to provide a centrifugal extraction system which is capable of operating in a continuous fashion with batch continuous washers.

It is also an object of the present invention to provide a method and apparatus for facilitating the loading and unloading of centrifugal extractors.

It is yet another object of the present invention to provide such a method and apparatus that lessens the likelihood of extractor load imbalances.

It is still another object of the present invention to provide a method and apparatus for transferring a plurality of discrete laundry batches in a continuous fashion between laundry processing stations.

These and other objects of the present invention are achieved by an apparatus for batch continuous extraction that continuously centrifugally extracts fluid from sequentially received batches of washed laundry. The apparatus includes a centrifugal extractor with a segmented drum divided into a plurality of compartments and a means for rotating the drum. The apparatus also includes means for automatically loading a batch of laundry into each of the compartments and means for automatically displacing the laundry from each of the compartments in the drum after a period of rotation of the drum.

In accordance with another embodiment of the present invention a method for batch continuous extraction involves continuously conveying a plurality of laundry batches from a washing machine to a centrifugal extractor. The batches of laundry are continuously and automatically loaded into each of the compartments in a segmented rotatable centrifugal extraction drum. The drum is rotated for a period of time to remove the fluid from the laundry batches. The laundry is thereafter automatically removed from each of the compartments after a period of rotation is completed.

In accordance with another embodiment of the present invention a batch continuous laundry transfer apparatus for transferring serially received, discrete batches of laundry between spaced laundry processing stations such as a washer and extractor includes a conveying mechanism with a generally horizontal laundry batch receiving surface. Means for automatically translating the mechanism with respect to one of the stations to arrange the serially received discrete batches in at least two side by side rows is provided. Also a means translates the mechanism from a position adjacent the first

station to a position adjacent the second station. Means for automatically unloading the laundry batches into second station are included as well.

In accordance with another embodiment of the present invention a method for transferring serially received discrete batches of laundry between spaced processing stations, such as a washer and an extractor, includes the step of arranging a conveying mechanism to receive a plurality of batches of laundry on a surface of the mechanism from a first laundry station. The positioning of a first batch of laundry on the surface is sensed. The mechanism is automatically shifted laterally to receive a second batch of laundry beside the first batch of laundry when the first batch is sensed. The surface is translated to enable the mechanism to receive a second pair of laundry batches on the surface. The laundry is then conveyed from the first station to the second station.

BRIEF DESCRIPTION OF THE DRAWING

FIG. **1** is a partially sectioned, side elevational view of one embodiment of the present invention in its lowered portion, partially showing a washer arranged to interact with the present invention;

FIG. **2** is a partially sectioned, side elevational of the embodiment shown in FIG. **1** in its raised position;

FIG. **3** is a plan view of the embodiment shown in FIG. **1**;

FIG. **4** is a plan view of the embodiment of the present invention shown in FIG. **3** after having been laterally shifted;

FIG. **5** is a plan view of the embodiment of the present invention shown in FIG. **4** after the conveyor belt has been rotated to a different position;

FIG. **6** is a plan view of the embodiment of the present invention shown in FIG. **5** shifted laterally, forwardly and vertically;

FIG. **7** is a plan view of the embodiment shown in FIG. **6** after the conveying system has been shifted longitudinally;

FIG. **8** is a partial cross-sectional view taken generally along the line **8—8** in FIG. **7**;

FIG. **9** is a partial, cross-sectional view of another embodiment of the present invention;

FIG. **10** is a partial cross-sectional view taken generally along the line **10—10** in FIG. **9**;

FIG. **11** is a partial cross-sectional view taken generally along the line **11—11** in FIG. **10**; and

FIG. **12** is a circuit schematic for the embodiment of the present invention shown in FIG. **1**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawing wherein like reference characters are used for like parts throughout the several views, a laundry washing and extraction plant **20**, shown in FIG. **1**, includes a washing machine **22**, a laundry transfer apparatus **24** and a centrifugal extractor **26**. While the washing machine **22** may take a wide variety of forms, the present invention is highly effective when used with a washer known as a tunnel washer which processes generally equally weighted, discrete batches of laundry in a continuous fashion, conventionally using an extremely large archimedian screw mechanism. After processing in the washing machine **22**, the wet laundry batches, indicated as **28**, exit from the washing machine **22** onto a slide **30**.

The laundry transfer apparatus **24**, arranged to receive the batches **28** from the washer **22**, includes a generally horizontal, rotatable, endless belt conveyor **32** mounted on a support frame **34**. The conveyor **32** includes a translatable platform **36** and a belt assembly **45** mounted on the platform **36**. The assembly **45** in turn includes an endless belt subassembly **47** mounted on the assembly **45**. The conveyor **32** is mounted to be vertically, laterally, and longitudinally translatable with respect to the support frame **34** and the surface **38** upon which the apparatus **24** rests. More particularly, as shown in FIGS. **1** and **3**, the support frame **34** includes a cross member **40**, resting on the floor **38**, that supports a pair of spaced, vertically extending, slotted posts **42**. Each slotted post **42** includes an inwardly facing track **44** which receives a pair of rollers **46** secured to the platform **36** so that the belt conveyor **32** may be translated vertically along the track **44** in each post **42**. A winch **43** is connected to the conveyor **32** by a chain **48** to power this vertical translation. The platform **36** is also connected by a pair of angled bars **50** to each of the slotted posts **42**. Each bar **50** includes a roller **49** which slides within a track **44** at a position elevated with respect to the position at which the rollers **46** engage the tracks **44**. Since the bars **50** are rigidly secured to the conveyor platform **36**, the chain **48** may be connected to the bars **50** to translate the conveyor **32** vertically.

As shown in FIG. **3**, the conveyor **32** is also laterally translatable since the platform **36** includes a set of tracks **56** that allow the belt assembly **45** to slide laterally or generally perpendicularly to a line connecting the extractor **26** and machine **22**. Conveniently a set of rollers **58** secured to the lower side of the belt assembly **45** rollingly engage and are secured within the tracks **56** to make this translation possible and to prevent the assembly **45** from leaving its tracks **56**. The lateral translation may be powered by a conventional chain drive including a winch **57** and chain **53** secured to the assembly **45** at one point and supported by a pair of pinions **55** (only one of which is shown).

Finally, as shown in FIGS. **7** and **8**, the conveyor **32** is longitudinally translatable towards and away from the centrifugal extractor **26**. This is due to the mounting of the subassembly **47** on the assembly **45**, through a set of transverse, linear rack gears **60**. The belt subassembly **47** is supported on the gears **60** by pinions **61** geared for movement with respect to the rack gears **60** in the directions indicated in FIG. **7**. The longitudinal translation of the belt subassembly **47** may be powered by a pair of motors **65** mounted on the subassembly **47**, each driving a pinion **61**.

The belt subassembly **47** includes an inclined, widened front end **64**, a pair of upstanding lateral walls **66** and an endless rotatable conveyor belt **68** also forming a part of the subassembly **47**. A central upstanding barrier **67** divides the belt **68** into two side by side regions. The free end **70** of the end portion **64** is generally circular, having a radius comparable to that of the extractor **26**. A ramp portion **71**, adjacent the free end **70**, is downwardly inclined and defines an angled ramp. The upstanding walls **66** in conjunction with the end portion **64** guide the batches of laundry **28** received on the apparatus **24** from the washing machine **22** to the centrifugal extractor **26**.

Within the extractor **26**, as shown in FIG. **8**, a rotatable basket **78** has a perforated or liquid permeable cylindrical wall **79** and a base wall **81**. The basket **78** is mounted for rotation and the wall **81** includes an inner generally bell-shaped portion **83** terminating in a hub **85** that connects to a motor driven shaft **98**. Surrounding

the basket **78**, an outer casing or enclosure **75**, having a generally cylindrical wall **77**, conforms to the basket wall **79**. A lower surface of base wall **81** supports a conventional bearing assembly (not shown) located within the bell-shaped portion **83**. Suitable drain structure (not shown) is provided for liquids extracted from material within the basket **78**.

The basket **78** receives a vertically reciprocable carrier **80** translatable between a position totally within the basket **78**, as shown in FIG. **3**, and a position raised out of and over the basket **78**, as shown in FIG. **8**. The carrier **80** has a lower surface **82** conforming to the base wall **81** and located closely adjacent to the basket wall **79**, an upper horizontal curb **84**, and a plurality of vertically arranged dividing walls **86**. The walls **86** extend from the upper curb **84** to the lower surface **82**, conform to the cylindrical wall **79** and divide the carrier **80** into four distinct compartments **88**. Each compartment **88** is pie-shaped and has a generally cylindrical, vertically aligned, open peripheral side **90**.

The carrier **80** is raised and lowered by a an actuator assembly **91** mounted on the hub **85** and including a cylindrical sleeve or tube **92**. The tube **92** is connected by a rotary union **94** to a source of pressurized fluid through a line **96**. The fluid pressure produced in the line **96** is communicated to a chamber (not shown) within the tube **92**, thereby translating a piston (not shown) with respect to the chamber. This causes the carrier **80** to be raised to its upstanding position. Upon release of the pressure, the carrier **80** falls to its lower position surrounding the shaft **98**. The carrier **80** is frictionally keyed to the shaft **98** to rotate with the basket **78** during extraction. Specifically, the tube **92** frictionally engages the rotating shaft **98** while the carrier **80** frictionally engages the base wall **81** so that the carrier **80** rotates with the basket **78**. A suitable mechanism for actuating the carrier **80** is described in U.S. Pat. No. 3,945,921 to Toth hereby expressly incorporated by reference herein in full.

The curb **84** is separable from the remainder of the carrier **80**. Normally the curb **84** moves upwardly and downwardly with the remainder of the carrier **80**. However, the curb **84** may be independently operated through the pneumatic cylinders **97**, mounted on the tube **92**, to vertically reciprocate separately of the remainder of the carrier **80**. This is conveniently accomplished by providing two passages in the rotary union **94** and line **96**, one passage to supply the carrier actuator **91** and the other to supply the pneumatic cylinders **97**.

The extractor casing **75** is supported atop three vibration and lateral movement damping suspension pedestal assemblies **100** positioned at regularly spaced positions around the rotational axis of the basket **78**. Each pedestal assembly **100** includes a housing portion **101** with a depending internal rod (not shown) attached through the agency of resilient spacers (not shown) to arm members (not shown) radially extending from the casing **75**. The suspension pedestal assemblies **100** are described in greater detail in U.S. Pat. No. 3,945,921 to Toth already incorporated by reference herein.

According to one preferred embodiment of the present invention, the centrifugal extractor **26** is surrounded by a circular conveyor **72** encircled by a circular upstanding wall **74**. An opening **76** is provided in the wall **74** to allow the transfer apparatus **24** access to the extractor **26**, as shown in FIG. **7**. The circular conveyor **72** is conveniently a conventional ring conveyor which includes a rotated annular surface **73**. A vacuum draw off conveyor **69**, extending through the wall **74**, is connected to a vacuum source, to remove the laundry from the conveyor **72**.

In accordance with another preferred embodiment of the present invention, shown in FIGS. **9–11**, a vacuum unloading mechanism **102**, that may replace the circular conveyor **72**, is provided for unloading the centrifugal extractor **26**. The mechanism **102** includes a vacuum conveying duct **104** connected to a vacuum source. The duct **104** is connected to a rigid interface member **106** by means of a flexible, expandable accordian conduit **108**. The position of the member **106** with respect to the upwardly translated carrier **80** may be adjusted through the operation of a pair of fluid actuated cylinders **110** mounted on each side of the duct **104** and connected to the interface member **106** by their reciprocating pistons **112**. Thus, reciprocation of the pistons **112** results in movement of the member **106** toward and away from the cylindrical open peripheral side **90** of an aligned compartment **88**, generally in the direction indicated by the arrows in FIG. **9**.

As shown in FIG. **10**, the member **106** includes a flared free end portion **114**. The portion **114** defines a tubular surface **115** that mates and conforms to the outer periphery of the carrier **80**. Secured to the surface **115**, a resilient, cylindical, frame-like gasket **116** provides an airtight seal between the member **106** and the open peripheral side **90** of a compartment **88** aligned with the mechanism **102** when the duct **104** is in position adjacent the carrier **80**. Thus, as shown in FIG. **11**, the flared portion **114** defines a rectangular opening **118** through which a vacuum applied to the duct **104** may be conveyed to the interior of a compartment **88** in sealed relationship with the member **106** and thus the duct **104**.

Referring now to FIG. **12**, a motor control circuit **120** includes a step programmer **122** and a relay bank **124** operative to control a plurality of motors **126**, responsible for the operation of the plant **20**, through the motor switch contacts **127**. The motors **126** are connected to the remainder of the circuit **120** by a conventional fuse box **128** and an on-off switch **130**. The step programmer **122** includes a rotary stepping switch **131**, a stepper or pulse generator **133**, a stepping motor **132**, and a plurality of cams **134** rotated by the motor **132**. The switch **131** and each of the cams **134** in the illustrated embodiment have 20 positions, indicated by slashed radial lines on each cam and partially numbered in FIG. **12**. Each cam **134** is arranged to interact with a cam following switch contact **136** pivotable between one of two contacts **138** and **140** arranged at angularly spaced positions near the free end of the contact **136**. The contact **136** normally makes a connection with the contact **140** whenever the contact **136** is not displaced by a cam **134**. The switch **131** includes a rotary wiper **135**, also stepped by the motor **132**, that makes an electrical connection with the twenty contacts **137**.

With the laundry transfer apparatus **24** in the position shown in FIG. **1**, arranged to receive an initial batch of laundry **28** from the tunnel washer **22**, the extractor motor **126***j* and the extractor **26** are running, and the cams **134** are in their number one positions. A circuit is completed by the cam **134***a* through the relay **142** responsible for positioning the conveyor assembly **45** in the lateral position shown in FIG. **3**. Similarly the cam **134***c* completes the circuit through the relay **144** responsible for positioning the subassembly **47** in its retracted position shown in FIG. **3**, closest to the washer **22**, and

cam **134***g* is connected through relay **146** to also maintain the conveyor in its retracted position closest to the washer **22**.

When the first batch of laundry **28***a* is located on the transfer apparatus **24**, as indicated in FIG. **3**, the photorelay **148** is actuated, closing the switch **149**. This completes a circuit through the stepper **131**, stepping the motor **132** to position two and causing each of the cams **134** to rotate to their second angular position. When the cam **134***a* moves to its second position, its contact **136** moves from a position electrically connected to the contact **140** to a position connected to the contact **138**. This produces an electrical connection through the contact **136** to the relay **150** responsible for operating the motor **126***a* that moves the transfer apparatus **24** from the position shown in FIG. **3** to the position shown in FIG. **4**. In the position shown in FIG. **4**, the transfer apparatus **24** is arranged to receive a second batch of laundry **28***b* in a position beside the batch of laundry previously received from the washer **22**. The movement of the apparatus **24** between the positions shown in FIG. **3** and FIG. **4** is accomplished by operating the winch motor **126***a* to rotate the pinions **55** and to drive the associated chain **53** to make the required linear translation. When the second laundry batch **28***b* is positioned on the transfer apparatus **24**, the second photorelay **152**, located opposite the photorelay **148**, is operated, closing switch **153** and stepping the motor **132** to position three.

With the cam **134***b* in its third position, the conveyor belt motor **126***b* is operated by the conveyor belt relay **154**, advancing the loads of laundry **28***a* and **28***b* from the position shown in FIG. **4** to the position shown in FIG. **5**. When the photorelay **156** is operated by the positioning of the laundry loads **28***a* and **28***b* near the end of the conveyor belt **68** closest to the extractor **26**, the switch **157** is closed and the timing motor **132** is stepped to position four causing the conveyor belt motor **126***b* to stop.

When a third laundry batch **28***c* is located on the transfer apparatus **24**, as shown in FIG. **5**, the photorelay **152** is again actuated, closing switch **153** and stepping the motor to position five. In step five, the cam **134***a* completes an electrical connection with the relay **150** causing the conveyor to move from the position shown in FIG. **5** to the laterally shifted position shown in FIGS. **3** and **6**. Again this is under the control of the motor **126***a* through operation of the chain drive. When the fourth laundry load **28***d* is received and sensed by photorelay **148**, the switch **149** is closed and the motor **132** steps to position number six.

In position number six, cam **134***c* moves the conveyor subassembly **47** longitudinally forward toward the extractor **26** due to the operation of the relay **158** which produces an electrical connection to the motor **126***c* which drives the pinion **61** on the rack gear **60**. Operation of the first stage forward limit switch **160** halts this movement and indicates that the apparatus **24** has undergone the first stage of its forward longitudinal movement. As indicated in dot-dashed lines in FIG. **5**, it is now in a position closer to but slightly spaced from the outer peripheral surface of the extractor **26**. Moreover, the end **59** of the transfer apparatus **24** previously positioned under the slide **30** is now clear of the slide **30**. The motor **132** is then stepped to position seven.

In position seven the cam **134***d* raises the conveying apparatus **24** from the position shown in dotted lines in FIG. **1** to the position shown in solid lines in FIG. **2**. Since the apparatus **24** is now clear of the slide **30** no interference occurs. The upward movement of the assembly **45** continues until the up limit switch **162** is operated. This upward movement is achieved through the relay **161** that operates the winch **43** and particularly through the operation of winch motor **126***i* and chain drive **48**. When the closure of the switch **162** is sensed, the relay **163** is operated and the subassembly **47** is again moved longitudinally toward the extractor **26**, undergoing the second stage of its forward longitudinal movement, until the second stage limit switch **164** closes. When the switch **164** is operated the stepping motor **132** is stepped to position number eight. At this point, as shown in FIG. **6** and in dotted lines in FIG. **2**, the conveyor free end **70** is aligned with the upstanding wall **74**, the adjacent ramp portion **71** completing the barrier formed by the wall **74** and closing the opening **76** therein.

In position number eight, the cam **134***e* closes the switch formed between its contact **136** and contact **140**. When the speed of rotation of the extractor basket **78** slows sufficiently, perhaps to 100 revolutions per minute, due to the opening of the extractor timer contacts, signaling the end of the extraction cycle, the low rpm switch **166** is closed, the unload pump motor **126***d* is then operated, a hydraulic valve is shifted as a result of current in the relay **168** and a time delay relay **170** is energized. The time delay relay **170** closes the contacts **172** actuating relay **173** to start the ring conveyor **72** motor **126***g* and the relay **175** to operate the blower motor **126***e*. The carrier **80** then raises from the position shown in FIG. **1** to the position raised over the drum, shown in FIG. **8**, causing the laundry to be thrown onto the ring conveyor **72**. The movement of the carrier **80** is due to the operation of the pump motor **126***d* that generates the needed fluid pressure, and a hydraulic valve which allows the fluid pressure to be conveyed to the actuator assembly **91**. The vacuum suction motor **126***f* may then be operated, developing a vacuum in the draw off conveyor **69** and causing the laundry to be removed from the ring conveyor **72**. The location of the carrier **80** in its full upward position operates the proximity switch **174** advancing the timing motor **132** to position number nine. After a predetermined period of operation the time delay relay **170** opens the contacts **172** shutting off the conveyor **72** and blower motor **126***e*.

The switch defined by the cam **134***e* is opened when the timing motor **132** moves to position nine, shutting off the pump motor **126***d*. The bleeding off of the fluid pressure generated in the actuator assembly **91** causes the carrier **80**, excluding the curb **80**, to move downwardly into the extractor **26**. The cam **134***f* operates the relay **192** that actuates the cylinders **97** to retain the curb **84** in its raised position. As the carrier **80** reaches the down position, the photorelay **177** closes the switch **179** to step the motor **132** to position ten.

In position ten after the zero speed switch **170** closes, indicating that the extractor has stopped rotating, cam **134***g* operates the relay **181** and moves the subassembly **47** longitudinally forwardly, undergoing its third stage of forward longitudinal movement, to the position shown in FIG. **7**, with its ramp portion **71** directly aligned over the compartments **88** in the extractor **26**. The cam **134***h* then operates the relay **183** that starts the index motor **126***h* to rotate the extractor basket **78** until the index proximity switch **174** is operated, indicating that two compartments **88** are aligned under the transfer apparatus **24** and stepping the motor **132** to position

eleven. In position eleven, the cam **134***h* opens a cam switch which stops the index motor **126***h*. The cam **134***b*, then closes the cam switch which starts the conveyor belt motor **126***b* to gravity unload the nearest two batches **28***a* and **28***b* from the transfer apparatus **24** into the adjacent and aligned compartments **88**. This results in the photorelay **148** being deenergized, closing the contacts **180** and stepping the motor **132** to position twelve.

At this point the conveyor belt motor **126***b* is deenergized due to the operation of cam **134***b*. Cam **134***h* closes a cam switch and starts the index motor **126***h*, rotating the basket **78** by 180°, until the proximity switch **174** is operated stepping the motor **132** to position thirteen. In step thirteen, the cam **134***h* opens the cam switch to stop the indexing motor **126***h* and cam **134***b* closes the cam switch to start the conveyor belt motor **126***b* to unload the last two loads **28***c* and **28***d* into the two newly aligned compartments **88**. The completion of loading of the extractor **26** is sensed by photorelay **156** which energizes and closes contacts **182** to step the motor **132** to its next position.

In position fourteen, cam **134***b* opens the cam switch to stop the conveyor belt motor **126***b* and cam **134***g* operates relays **146** and **147** to retract the subassembly **47** towards the washer **22**. The movement of the subassembly **47** along the rack **60** continues until the second stage retract limit switch **188** is closed, stepping the motor **132** to position fifteen. Thus, the forward longitudinal movement accomplished in the second and third stages is reversed in a single stage retraction.

The assembly **45** is now lowered from the position shown in solid lines in FIG. **2** to the position shown in dotted lines in FIG. **1** due to the action of cam **134***d* which operates the lower relay **190**. At the same time cam **134***f* disconnects the relay **192** and connects the vacuum pump relay **194** to operate the pump motor **126***k* and to lower the curb **84**. When the curb **84** is in its lowered position, a photorelay **196** operates switch **197** and steps the motor **132** to position sixteen.

In position sixteen, the cam **134***c* closes the cam switch to longitudinally retract the assembly **47**, once the down limit switch **198** is closed. Cam **134***c* energizes a time delay **200** to close the contacts **204** connecting a solenoid valve **202** to reset the extractor timer. The first stage retract limit switch **206** is closed by the subassembly **47** to step the motor **132** through positions **17** through **20** to position number **1**. The apparatus **24** is then back in its original position, under the slide **30**. At this point the apparatus is ready to recycle through the steps described previously.

The embodiment illustrated in FIGS. **9–11** may be implemented generally in manner described above. However, only a two stage longitudinal movement of the assembly **47** is required, the second of the three stages of movement described previously now being unnecessary. In addition unloading does not occur until the rotation of the basket **78** is stopped. Instead of actuating the ring conveyor **72** in step eight, the unloading mechanism **102** may be operated to sequentially engage each compartment **88** and to vacuum remove the batch **28** contained therein. Due to the sequential removal of these batches their discrete character is preserved by the unloading mechanism **102**. In this way it is possible to process batches of laundry so that each batch is maintained in tact through out its processing. This facilitates sorting of the laundry and enables special treatment of certain batches.

In any case, the use of the segmented carrier **80** divides the laundry load into separated, sufficiently evenly weighted portions so that load imbalance problems are unlikely. The scraping action provided by the carrier **80** during its upward reciprocation frees the laundry from the basket **78** walls so that it may be easily unloaded.

Although only two methods and apparatus for automatically removing the laundry from the extractor after the completion of the extractor cycle have been described, it will be obvious that a number of different positive, automatic systems may be used in place of the methods and apparatus described herein to implement the present invention. For example, an air inflatable bag (not shown) may be located within the radially innermost position within each compartment **88** of the carrier **80** so that upon completion of an extraction cycle the carrier may be raised to its upward position and the bags may be sequentially inflated to displace the laundry from each of the compartments. An appropriate conveyor can be aligned to receive each batch of laundry as it is expelled by the air bag expulsion system. For example, a first batch of laundry may be expelled from the first compartment, the carrier may then be rotated to the same position at which expulsion previously occurred and the next batch may then be expelled. Alternatively, a "canvas" bag removal system (not shown) may be implemented by canvas bag that lines the innermost peripheral surfaces of each compartment. Upon completion of the extraction cycle and appropriate positioning of the carrier **80**, as described previously, the bag may be pulled outwardly causing the laundry to be expelled. Still another alternative uses a mechanical arm (not shown), the carrier **80** being appropriately positioned to enable the robot arm to positively remove the laundry onto a suitable conveying system.

While the carrier **80** has been described as having four compartments **88** it will be obvious that the carrier may have any number of compartments. However, it is advantageous to use an even number of compartments to enable dual loading of the compartments. For most anticipated applications it is preferable to use four or six compartments with the present invention.

Although the motor control for the plant **20** is described herein as a cam actuated system, those skilled in the art will appreciate that a computerized or microcomputerized system may be used instead. Moreover, the computer control for the extractor **26** and the apparatus **24** may advantageously be combined with a washer **22** computer control system.

The foregoing detailed description has been given for clearness of understanding only and no unnecessary limitations should be understood therefrom as many modifications will be obvious to those skilled in the art.

What is claimed is:

1. A method for batch continuous extraction comprising the steps of:

continuously conveying a plurality of discrete laundry batches from a washing machine to a segmented, rotatable centrifugal extractor having a plurality of compartments;

aligning one of the laundry batches with one of said compartments;

continuously loading one of said batches of laundry automatically into each of the compartments of the segmented, rotatable centrifugal extraction drum;

rotating said drum for a period of time sufficient to remove the fluid from said laundry batches; and

automatically expelling said laundry from each of said laundry compartments after said period of rotation is completed.

2. The method of claim **1** wherein the step of continuously conveying a plurality of laundry batches includes the steps of receiving a plurality of batches one at a time on a conveyor, displacing said conveyor to arrange a plurality of batches in an ordered array on said conveyor, and translating said conveyor and said batches to a position to load said batches into said extractor.

3. The method of claim **2** including the steps of receiving a first batch atop said conveyor, laterally translating said conveyor to a second position to receive a second batch in a position alongside the first batch, rotating said conveyor to advance said first pair of batches to a new position, and receiving a second pair of batches in the positions previously occupied by the first pair of batches.

4. The method of claim **3** including the step of loading a pair of batches into different compartments in said drum, two at a time.

5. The method of claim **1** including the step of automatically indexing said segmented extractor drum to receive said batches one after another into compartments within said drum.

6. The method of claim **1** wherein said loading step includes the steps of automatically uncovering the compartments of the extractor to enable said compartments to receive said batches, and thereafter automatically re-covering said carrier.

7. The method of claim **1** wherein said step of automatically expelling said laundry from each of said compartments includes the steps of raising a portion of said drum from a position within said extractor to a position over said extractor, elevating said laundry with said portion, and rotating said portion so as to expel said laundry from said portion.

8. The method of claim **7** including the steps of expelling said laundry onto a surrounding conveyor system, and conveying said laundry on said conveyor to a position away from said extractor.

9. The method of claim **1** wherein said automatic expelling step includes the step of applying a vacuum to each of the compartments within said drum to remove said laundry from each of said compartments.

10. The method of claim **9** including the step of indexing each of said compartments to a position to have a vacuum applied to its interior and applying a vacuum sequentially to each of said compartments to sequentially remove said laundry from said compartments.

11. The method of claim **10** including the steps of initially raising said laundry to a position over said extractor, and then sequentially vacuum extracting said laundry from each of said compartments.

12. An apparatus for batch continuous extraction that continuously centrifugally extracts fluid from sequentially received batches of laundry, the apparatus comprising:

a centrifugal extractor including a segemented drum divided into a plurality of compartments and a means for rotating said drum;

means for aligning a discrete batch of laundry with each compartment and means for automatically loading one of said discrete batches of laundry into each of said compartments; and

means for automatically displacing said laundry from each of said compartments after a period of rotation of said drum.

13. The apparatus of claim **12** wherein said extractor drum rotates around a vertical axis and said drum includes a vertically reciprocatable carrier movable from a first position within the drum to a second position over the drum.

14. The apparatus of claim **13** wherein said carrier defines said plurality of compartments within said drum, each of said compartments having an open peripheral side.

15. The apparatus of claim **14** wherein said carrier is keyed to rotate with said drum.

16. The apparatus of claim **14** wherein said carrier includes a cover separable from the remainder of said carrier to enable said carrier to be loaded.

17. The apparatus of claim **12** wherein said automatic loading means includes a transfer mechanism including an endless belt conveyor and means for translating said mechanism in three dimensions.

18. The apparatus of claim **17** wherein said transfer mechanism includes means for arranging said sequentially received batches of laundry in an ordered array on said mechanism.

19. The apparatus of claim **18** wherein said arranging means arranges said batches in two rows.

20. The apparatus of claim **18** wherein said transfer mechanism includes means for arranging a plurality of batches on said mechanism equal in number to the number of compartments within said drum.

21. The apparatus of claim **18** wherein said endless conveyor belt includes a dividing means for dividing said conveyor belt into two separated regions.

22. The apparatus of claim **17** wherein said transfer mechanism includes means for automatically receiving said batches of laundry at one elevation, means for arranging said batches in an ordered array, means for elevating said batches to a second elevation and means for transferring said batches two at a time into said segmented drum.

23. The apparatus of claim **22** wherein said automatic loading means includes a photoelectric sensor for sensing the presence of said batches on said transfer mechanism.

24. The apparatus of claim **23** wherein said automatic loading means includes means for receiving a first batch of laundry at one level, means operative in response to receipt of said first batch of laundry, for shifting the position of said mechanism in the same plane.

25. The apparatus of claim **24** wherein said automatic loading means includes means for rotating said endless belt conveyor when first and second batches have been located on said mechanism in order to shift said batches to a new position on said conveyor and to enable said mechanism to receive another pair of laundry batches.

26. The apparatus of claim **25** including means for vertically shifting said conveyor in response to receipt of a number of batches of laundry equal to the number of compartments in said drum, and means for translating said mechanism with respect to said centrifugal extractor so as to position said batches to be received within said extractor.

27. The apparatus of claim **12** wherein said automatic displacing means includes means for centrifugally displacing said laundry from said extractor.

28. The apparatus of claim **27** wherein said centrifugal displacing means includes a vertically reciprocable carrier, translatable between a first position located within said drum and a second position raised over said drum, said carrier arranged to displace said laundry out

of said drum, said carrier further including means for rotating said carrier when said carrier is displaced from said drum so as to expel said laundry therefrom.

29. The apparatus of claim **28** including a conveying system surrounding said extractor and arranged to receive said laundry from said automatic displacing means.

30. The apparatus of claim **29** wherein said conveying system includes a ring conveyor encircling said extractor.

31. The apparatus of claim **12** wherein said automatic displacing means includes a vacuum apparatus arranged to withdraw the laundry from each of said compartments.

32. The apparatus of claim **31** wherein said automatic displacing means includes a reciprocable carrier for displacing said laundry from the interior of said drum to a position raised over said drum, said carrier divided into a plurality of compartments, each of said compartments having an open peripheral side, said vacuum apparatus arranged to sealingly mate with said open peripheral side so as to withdraw the laundry from said compartment.

33. The apparatus of claim **32** wherein said vacuum apparatus includes a translatable head positionable in a first position spaced from said extractor and movable to a position mating with the open peripheral side of one of said compartments.

34. The apparatus of claim **33** wherein said head is automatically displaceable in response to the termination of the extraction cycle to a position to receive said laundry from at least one of said compartments, said rotating means including means for indexing each of said compartments to a position aligned with said vacuum apparatus.

35. A batch continuous laundry transfer apparatus for transferring serially received, discrete batches of laundry between first and second spaced laundry processing stations, such as a washer and an extractor, said apparatus comprising:

a conveying mechanism disposed between said first and second stations having a generally horizontal, laundry batch receiving surface;

means for automatically translating said mechanism with respect to said first station to arrange said serially received discrete batches in at least two side by side rows;

means for translating said mechanism from a position adjacent said first station to a position adjacent said second station;

means for aligning said rows of discrete batches with a pair of distinct compartments at said second station; and

means for automatically loading said laundry batches into said compartments of said second station.

36. The apparatus of claim **35** wherein said conveying mechanism includes an endless belt conveyor mounted for translation in any dimension.

37. The apparatus of claim **35** wherein said automatic translating means includes means for shifting said conveying mechanism generally in a horizontal plane, perpendicularly with respect to the direction from which said batches are received by said mechanism.

38. The apparatus of claim **37** including first sensing means for determining when a first batch has been received on said surface and means for operating said shifting means when said sensing means senses said first batch.

39. The apparatus of claim **38** wherein said conveying mechanism includes an endless belt conveyor defining said surface, said apparatus including second sensing means for sensing when a pair of side by said batches have been received by said conveyor and means for indexing said endless belt conveyor when said second sensing means detects a pair of batches on said conveyor.

40. The apparatus of claim **39** including means for dividing said endless belt conveyor into a pair of separated portions.

41. The apparatus of claim **36** wherein said conveyor is translatable towards one of said stations in at least two discrete stages.

42. The apparatus of claim **35** wherein said automatic unloading means is arranged to feed said batches two at a time.

43. A method for transferring serially received discrete batches of laundry between first and second spaced processing stations, such as a washer and an extractor, said method comprising:

arranging a conveying mechanism to receive a plurality of batches of laundry on a surface of said mechanism, from said first laundry station,

sensing the positioning of a first batch of laundry on said surface;

automatically laterally shifting said mechanism to receive a second batch of laundry beside said first batch of laundry when said first batch is sensed;

translating said surface to enable said mechanism to receive third and fourth laundry batches on said surface;

indexing said first and second laundry batches in alignment with two compartments disposed in a laundry processing device at said second station; and

conveying said laundry from said first station to said second station to load said first and second laundry batches into said two compartments.

44. The method of claim **43** wherein the step of conveying said laundry from said first station to said second station includes the step of unloading said batches two at time into said second station.

45. The method of claim **44** including the step of translating said surface with respect to the remainder of said mechanism to move said batches from said mechanism to said second station.

46. The method of claim **42** wherein the step of conveying said laundry includes the step of elevating said conveyor to a position over said second station.

47. The method of claim **46** including the step of positioning said mechanism beneath at least a portion of said first station and translating said mechanism toward said second station in at least two stages.

48. An apparatus for batch continuous extraction that continuously centrifugally extracts fluid from sequentially received batches of laundry, the apparatus comprising:

a centrifugal extractor including a segemented drum divided into a plurality of compartments and a means for rotating said drum;

means for automatically loading a batch of laundry into each of said compartments; and

means for automatically displacing said laundry from each of said compartments after a period of rotation of said drum, wherein said automatic displacing means includes a reciprocable carrier for displacing said laundry from the interior of said drum

to a position raised over said drum, said carrier divided into a plurality of compartments, each of said compartments having an open peripheral side, and vacuum apparatus arranged to sealingly mate with said open peripheral side so as to withdraw the laundry from said compartment, wherein said vacuum apparatus includes a translatable head positionable in a first position spaced from said extractor and movable to a position mating with the open peripheral side of one of said compartments.

49. The apparatus of claim **48** wherein said head is automatically displaceable in response to the termination of the extraction cycle to a position to receive said laundry from at least one of said compartments, said rotating means including means for indexing each of said compartments to a position aligned with said vacuum apparatus.

50. A method for batch continuous extraction comprising:

continuously conveying a plurality of discrete laundry batches from a washing machine to a centrifugal extractor having a plurality of compartments;

continuously loading one of said batches of laundry automatically into each of the compartments of the segmented, rotatable centrifugal extraction drum;

rotating said drum for a period of time to remove at least a portion of the fluid from said laundry batches; and

automatically expelling said laundry from each of said laundry compartments after said period of rotation by indexing each of said compartments to a position to have a vacuum applied to its interior and applying a vacuum sequentially to each of said compartments to sequentially remove said laundry from said compartments.

51. The method of claim **50** including the steps of initially raising said laundry to a position over said extractor, and then sequentially vacuum extracting said laundry from each of said compartments.

52. An apparatus for batch continuous extraction for extracting fluid from sequentially received batches of laundry, the apparatus comprising:

a centrifugal extractor including a segmented drum divided into a plurality of compartments and means for rotating said drum;

means for delivering a plurality of discrete batchs of laundry to said segmented drum;

means for aligning one of said discrete laundry batches with each compartment of said drum; and

means for loading a discrete batch of laundry into each of said aligned compartments.

53. The apparatus of claim **52** wherein said extractor drum includes a vertically reciprocatable carrier movable from a first position within the drum to a second position over the drum.

54. The apparatus of claim **52** wherein said means for aligning said laundry batch with a compartment of said drum includes a conveyor disposed to deliver a discrete laundry batch to one or more predetermined areas aligned with said drum and means for rotating the drum to a predetermined position to dispose said compartment in alignment with said predetermined area.

55. The apparatus of claim **54** including means for rotating said drum in a step-wise fashion to index each compartment in alignment with one of said predetermined areas to deliver a discrete laundry batch to each of said compartments.

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